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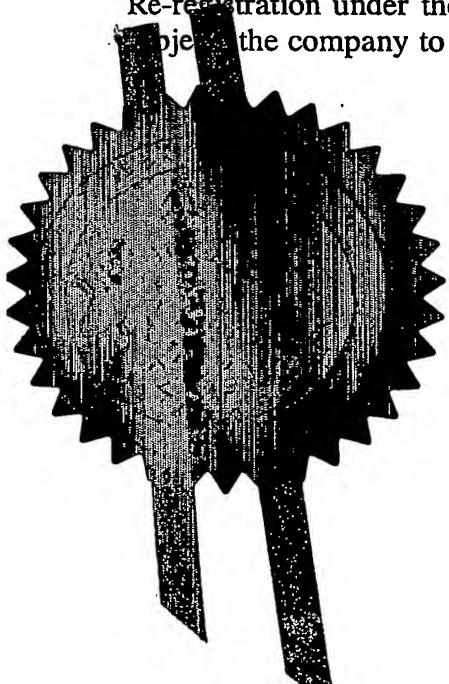
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1. Your reference

AW/P201568GB

18 JUL 2003 E82363A-1 D04335

2. Patent application number

(The Patent Office will fill in this part)

0316864.8

18 JUL 2003

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)Linertech Limited, Wellington Mills, Québec Street,
ELLAND, West Yorkshire, HX5 9BX.Patents ADP number (*if you know it*)

8544744001

If the applicant is a corporate body, give the country/state of its incorporation

GB

4. Title of the invention

IMPROVEMENTS IN AND RELATING TO
CONTAINER LINERS.5. Name of your agent (*if you have one*)

W.P. THOMPSON & CO.

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)Kings Building
South Church Side
HULL
East Yorkshire
HU1 1RRPatents ADP number (*if you know it*)

158004

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application numberCountry Priority application number Date of filing
(*if you know it*) (Day/month/year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application Date of filing
(Day/month/year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'yes' if:

Yes

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Patents Form 1/77

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Description

9

Claims(s)

Abstract

Drawing(s)

3 → 3 (2)

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents
(Please specify)

11. I/We request the grant of a patent on the basis of this application

Signature

Date 17 July 2003

W.P. THOMPSON & CO.

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr. A. J. A. Walker
Tel: 01482 223451

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DESCRIPTION"IMPROVEMENTS IN AND RELATING
TO CONTAINER LINERS"

5 The present invention relates to container liners used for the transport of compactable, cohesive powders. More specifically the present invention relates to a device for fluidising powdered material contained within a container liner within a shipping container.

10 There are many dry materials in fine particulate form which readily compact and bind together, showing a characteristically high angle of repose and difficult flow properties. Such powders commonly cause great difficulty on discharge from a shipping container, as they will not flow freely when the container is tipped, even at angles of 45° or more.

15 In order to facilitate the discharge of such materials from shipping and other storage containers it is known to fluidise the material by causing air to pass through it.

One known device for achieving fluidisation of powdered materials within a container liner comprises a fluidising mat which is placed within and at the bottom of the container liner prior to filling. The mat comprises two layers which are sealed along their edges and the uppermost of these two layers has micro-perforations in it. Air under 20 pressure is introduced between the two layers and passes through the micro-perforations in the upper layer to cause fluidisation of the powdered material contained within the liner.

Although this known device has succeeded to some degree in facilitating the discharge of fine particulate compactable powders from storage containers, there are a number of disadvantages which have prevented its widespread use. These disadvantages include:

- 5 a) The fact that the two flexible layers of the mat lie flat one on top of the other during loading, storage and transport. Given the weight of the cargo that lies on the mat in use, there is considerable resistance to the penetration of the injected gas between the layers, and hence to its even distribution under the cargo.
- 10 b) Many of the mats are divided into discrete sections or pockets in order to facilitate better control of the distribution of the injected gas. However, the ridges created between the pockets commonly trap material making discharge difficult. Moreover, the separation of the mat into discrete pockets also requires the use of a complex manifold to distribute the air under pressure to each of these pockets.
- 15 c) Material is commonly trapped between the edge of the fluidising mat and the container walls from where it is difficult to discharge. Attempts to overcome this problem by extending the fluidising mat up the sides of the container have met with limited success due to creasing problems and the higher initial cost of the mat.
- 20 d) When the discrete pockets of the fluidising mat are inflated they have a tendency to balloon. As the width of the pockets reduces the fluidising

mat tends to pull away from the side walls of the container. This results in material being trapped down the sides of the fluidising mat from where it is difficult to discharge. To solve this problem it has been proposed to secure the fluidising mat along its edges to the liner and thereby maintain it at its full width, but this solution has proved complicated, expensive and not very effective.

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e) The pervasive dusting which follows fluidisation by the high pressure air commonly used in this type of mat generally requires the provision of filtration equipment to reduce the egress of dust into the atmosphere.

10 WO-93/04954 discloses a fluidising mat which seeks to overcome at least some of these disadvantages. The mat is of rigid construction and comprises an upper non-flexible sheet and a lower non-flexible gas impermeable sheet held in spaced apart superimposed relationship by a plurality of rigid ribs which extend longitudinally between the upper and lower planar sheets to form an array of separate channels that extend substantially the full area of the mat. These channels are open at one end and closed at the other. Air is fed to each of the channels by a gas manifold which extends the full width of the mat to take in all the open ends of the channels. The upper planar sheet and the upper portion of the gas manifold have a plurality of micro-perforations therein.

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20 The rigid structure of this fluidising mat has several advantages. Since the upper and lower layers of the mat are permanently held apart by the rigid ribs, the injected air is freely distributed and flows to all parts of the mat. Furthermore the gap between the

upper and lower layers provides an effective plenum chamber which in turn ensures an even pressure distribution over the surface of the mat.

The rigid construction of this mat also prevents any ballooning of the mat with the resultant retraction from the walls of the container. Furthermore, it can eliminate the ridges between the sections of a flexible mat, since all parts of the mat can be of the same thickness.

A further advantage of this fluidising mat is that there is no need to inject high pressure air into the mat to lift the cargo and separate the upper and lower layers of the mat thereby allowing distribution of the air within the mat.

10 Although this fluidising mat provides means for facilitating the discharge of fine particulate compactable powders from storage containers, there are still a number of practical disadvantages which have limited its commercial use. These are:

- a) The rigidity of the fluidising mat often necessitates that it be fitted at the time of fitting the liner. This in turn requires that fitters enter the liner through the hatches of the container. However, the possibility of ingress of contamination into the liner does in many cases make this totally unacceptable.
- b) Commercial exploitation of the rigid mat has been further hampered by the high cost of this type of mat.
- c) The size of the liner and fluidising mat together makes transport difficult, since the rigid mat cannot be folded down in size like the liner.
- d) The design of the mat with separate longitudinally extending channels

requires the use of a relatively complex manifold to connect the open end of each channel to the air supply.

It is an object of the present invention to resolve the problems associated with conventional fluidising mats referred to hereinabove by providing a flexible low cost fluidising mat which can easily be transported and installed into a shipping container and which will allow such materials to be discharged completely and with minimal dusting.

It is another object of the present invention to provide a fluidising mat which can be formed as an integral part of a container liner

It is still another object of the present invention to provide a fluidising mat which incorporates the advantages of a permanent plenum chamber and the attendant lower operating pressures and air volumes together with the flexibility to allow incorporation of the mat within a container liner at manufacture, and subsequent folding or rolling of the liner to allow a compact package for transport.

It is yet another object of the present invention to provide a fluidising mat which allows free distribution of air throughout the plenum chamber from a single entry point.

According to a first aspect of the present invention there is provided a fluidising mat comprising an upper sheet having a plurality of micro perforations therein and a lower gas impermeable sheet, the upper and lower sheets being maintained in spaced apart superimposed relationship by load bearing means, wherein the load bearing means defines a plurality of passageways that extend in different directions over substantially the full area of the fluidising mat and intersect with each other to form a single continuous plenum chamber between the upper and lower sheets.

The passageways defined by the load bearing means allow air to pass freely and ensure even pressure distribution throughout the fluidising mat. Consequently, it is not necessary to employ complex manifolds to distribute air under pressure around the fluidising mat. Instead, a single point connection can be employed to connect the fluidising mat to a source of pressurised air or gas. This single point connection may be located anywhere in the perimeter of the fluidising mat. Conveniently, the single point connection is located in the perimeter of the fluidising mat adjacent to the discharge end of the container.

The air pressure required to fluidise the cargo is significantly lower with the fluidising mat of the present invention than it is with conventional fluidising mats. Consequently, there is little tendency for the fluidising mat to balloon or pillow. However, to safeguard against the load bearing means may be attached or bonded to both the upper and lower flexible sheets. The upper and lower sheets may each be attached or bonded to the load bearing means over the full surface thereof. However, it may be more convenient to provide point connections between the upper and lower sheets and the load bearing means at strategic locations through the fluidising mat.

The load bearing means may be formed from bonded fibre structures, flexible open cell foams, sintered polymeric structures, foam beads, air bubbles formed from film, or three-dimensional structures formed from superimposed layers of net-like structures. All of the foregoing must be of sufficient compressive resistance to prevent crushing under the loads experienced in a loaded container.

The perforated upper layer may be made from anti-static or electrically conductive

materials, which combined with a liner made from a conductive material may be used in situations where there is a risk of dust explosion due to an electrostatic discharge.

The fluidised mat may be situated anywhere on or in the liner, i.e. floor, roof and/or walls. In a preferred embodiment of the present invention the fluidising mat is an integral part of a container liner with the perforated upper sheet forming at least a part of the floor of the container liner. This embodiment has the advantage of making it unnecessary for an operative to enter the liner to fit the fluidising mat therein, with the consequent risk of contamination of the liner interior. Where the fluidising mat is fitted within the liner it is desirable to provide retaining means to ensure that it does not move within the liner and is not discharged therefrom with the material when the container is tipped. Such retaining means are already known within the prior art.

Preferably, the upper and lower sheets and the load bearing means are comprised of flexible materials, thus allowing the fluidising mat to be folded up for ease of transport. This also allows for some variation in the internal dimensions of the shipping container.

To facilitate fluidisation of the contents of the container liner when full, the fluidising mat is situated at least in the region of the liner immediately adjacent to the discharge port or ports.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a partial cut away perspective view of a first embodiment of the fluidising mat of the invention;

Figure 2 is a partial cut away perspective view of a second embodiment of the fluidising mat of the invention; and

Figure 3 is a partial cut away perspective view of a third embodiment of the fluidising mat of the invention.

5 Referring to Figure 1 the fluidising mat comprises an upper sheet 2 having micro-perforations 1 throughout the surface thereof and a gas impermeable lower sheet 3. The upper and lower sheets 2 and 3 are maintained in spaced apart superimposed relationship by load bearing means 5 which takes the form of a plurality of sealed air bubbles formed by an intermediate sheet of film bonded or welded to the lower sheet 3. The air bubbles 10 5 formed between the lower sheet 3 and the intermediate film can be compared with bubble wrap.

15 Between the load bearing air bubbles 5 numerous interconnected pathways are formed, such that gas or air injected between the upper and lower sheets at one point in the perimeter of the fluidising mat can pass freely and evenly throughout the entire area of the fluidising mat. This is in marked contrast to the prior art which requires the use 20 of complex gas manifolds that allow air under pressure to be distributed to individual and separate pockets or channels in the fluidising mat.

The load bearing air bubbles 5 must be of sufficient compressive resistance to withstand crushing under the loads experienced in a loaded bulk cargo container. 25 However, as a general rule these are not excessive.

Some or all of the load bearing air bubbles 5 may be bonded or otherwise attached to the upper sheet so as to prevent the sheet from forming a pillow or balloon.

as the fluidising mat is pressurised.

Referring to Figure 2 the fluidising mat again comprises an upper sheet 2 having micro-perforations 1 throughout the surface thereof and a gas impermeable lower sheet 3, and once the upper and lower sheets 2 and 3 are maintained in spaced apart 5 superimposed relationship by load bearing mean 4. However, in this embodiment the load bearing means comprises an open cell foam structure or sintered granular structure. The spaces in the foam or sintered granular structure form numerous interconnected pathways extending in all directions throughout the area of the fluidising mat. This ensures the free and even distribution of air under pressure throughout the fluidising mat.

10 The fluidising mat of Figure 3 is essentially identical to that of Figures 1 and 2, except that in this embodiment the load bearing means provided between the upper and lower sheets takes the form of an interwoven filamentary structure 7. This filamentary structure 7 defines numerous pathways extending in all directions throughout the area of the fluidising mat, thus allowing air under pressure to be distributed freely and evenly. 15 throughout.

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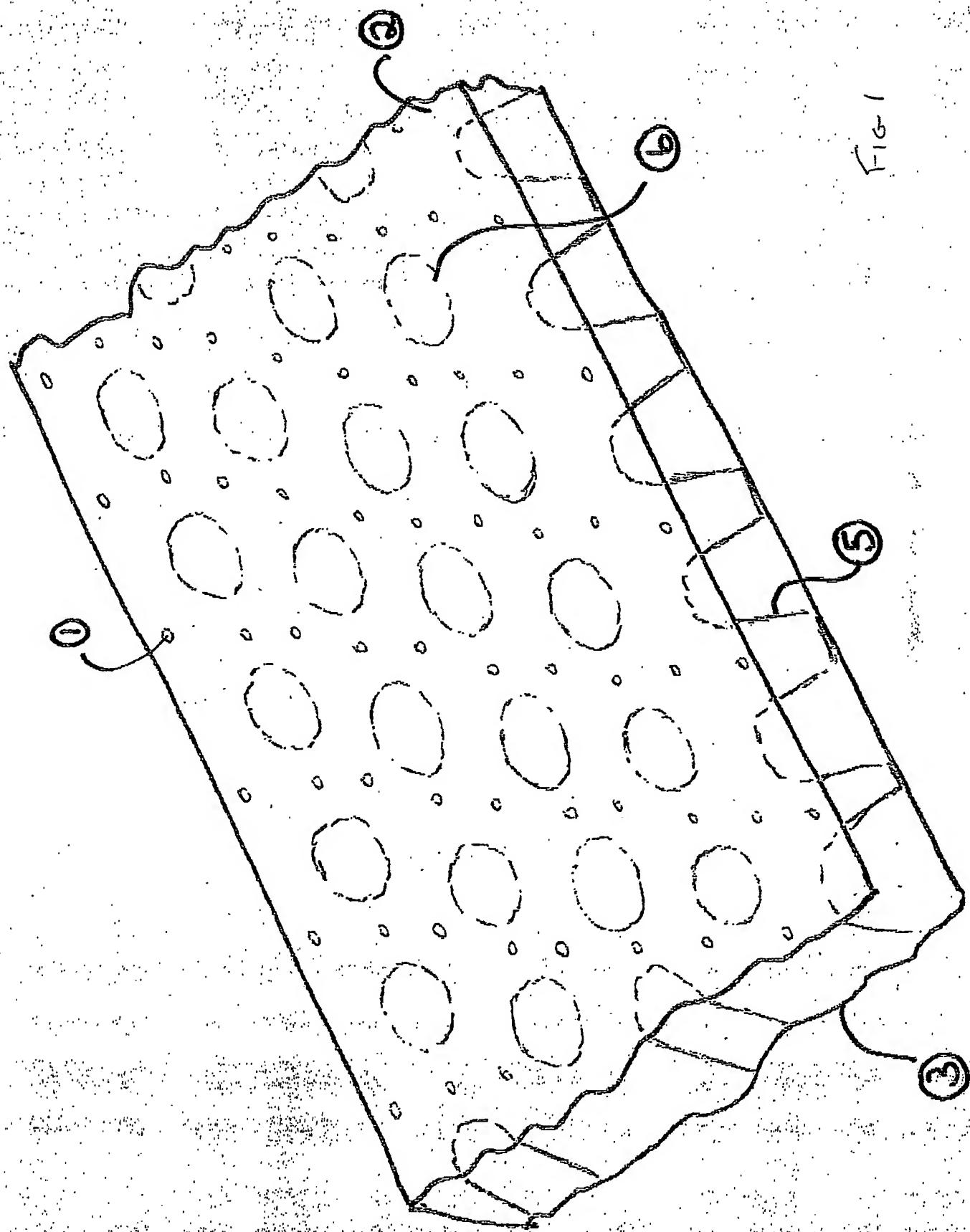


Fig. 1

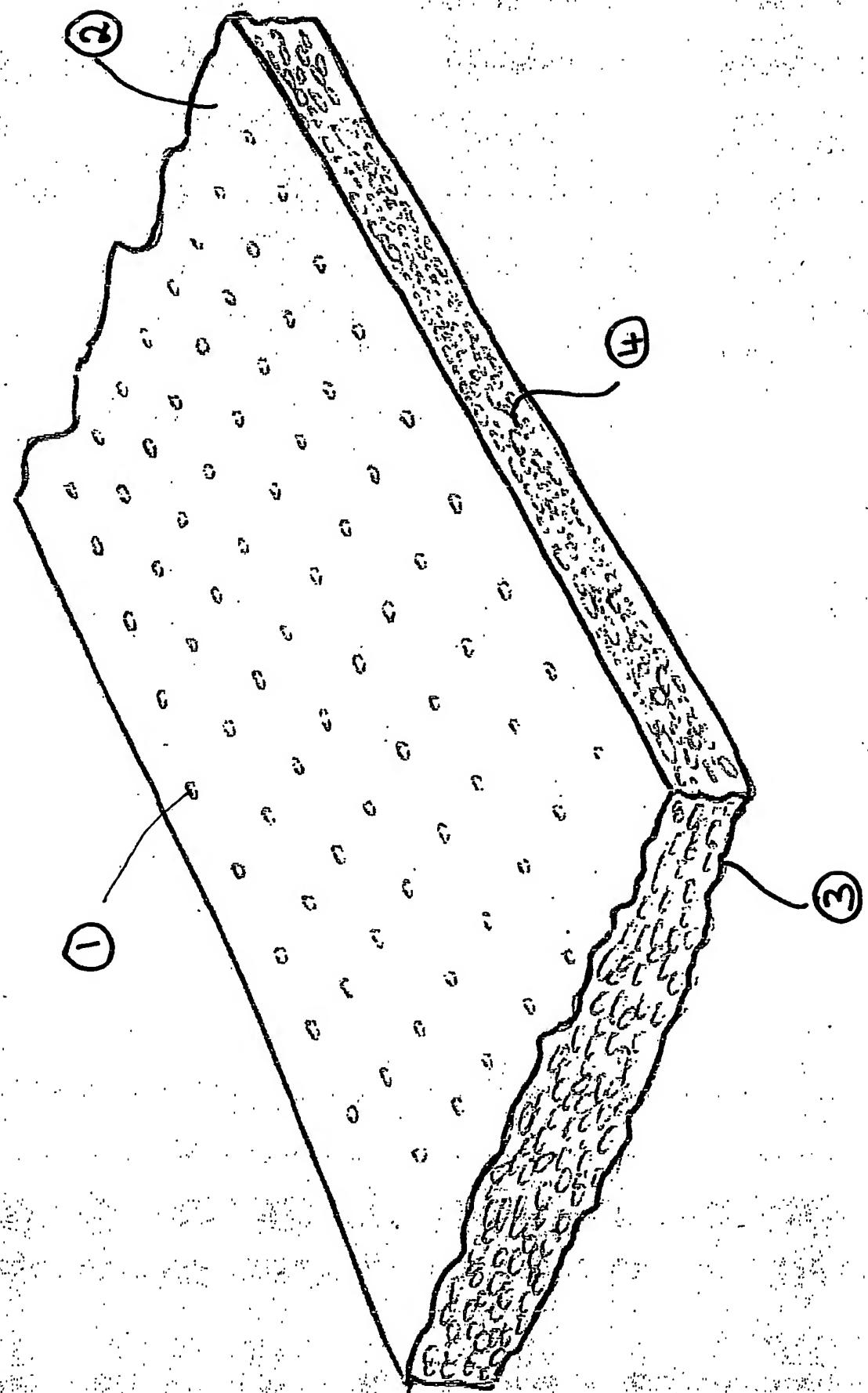
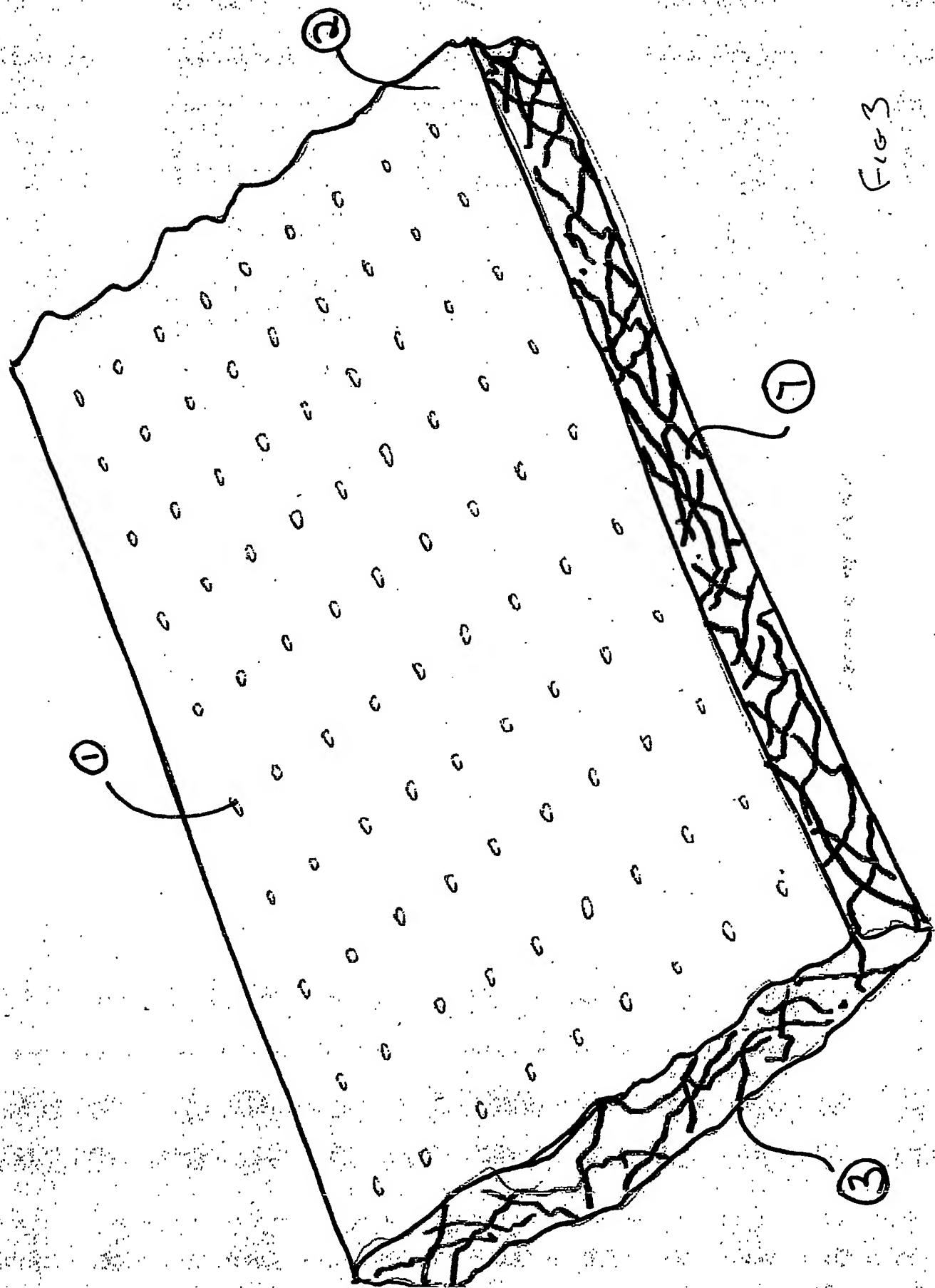


Fig. 2

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Fig 3



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